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TITLE: Gulf War Illness as a Brain Autoimmune Disorder

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14. ABSTRACT The primary emphasis of the first year of the grant has been obtaining regulatory approval for study procedures and initial identification and recruitment of study participants. We have completed 37 acquisitions and have several more scheduled. Given the early phase of the study, we have not begun analyzing data.					
15. SUBJECT TERMS Gulf War Illness, Autoimmune, neuroimaging, genetics, biomarkers					
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1. **INTRODUCTION:**

GWI has affected a large number of veterans of the 1990-1991 Persian Gulf War. GWI symptoms are characterized by chronic health problems, of unknown etiology. They resemble symptoms seen in various autoimmune disorders and are reflected in altered patterns of brain function. In this study, we comprehensively assess the association of GWI to autoimmune disorders using cutting-edge measures of brain structure and function, genetic analysis, and laboratory tests. In preliminary studies, we have discovered that GWI possesses a distinct functional brain pattern that is very close to that observed in a well-known autoimmune disorder, Sjogren's syndrome. Hence, the main goal of this proposal is to test the hypothesis that GWI is an autoimmune disorder. For that purpose, we are comparing the results of brain, genetic and laboratory tests in subjects with GWI to those obtained from subjects with known autoimmune disorders, to determine the extent to which GWI reflects autoimmune abnormalities. Altogether, our study will improve knowledge of GWI pathophysiology and ultimately inform diagnosis and potential treatment of GWI, e.g. along lines currently in use for treating autoimmune disorders. It is expected that useful outcomes will be obtained by the end of the 3-year grant period.

2. **KEYWORDS:** Gulf War Illness, autoimmune, neuroimaging, genetics, biomarkers

3. **ACCOMPLISHMENTS:**

▪ **What were the major goals of the project?**

The major goals of the project are to assess and compare 1) brain structure and function, 2) blood inflammatory and immune markers; 3) HLA genes; and 4) cognitive, mental health, neurological and general standardized clinical status in veterans with Gulf War Illness relative to veterans with autoimmune disorders.

▪ **What was accomplished under these goals?**

During this reporting period, we obtained regulatory approval for study procedures and have completed 37 acquisitions. In addition, we have identified over 100 veterans who are potentially eligible for the study. We have coordinated with staff from Rheumatology to facilitate recruitment of veterans with autoimmune conditions and have coordinated with Radiology to finalize the MR sequence on the Minneapolis VA's newly installed scanner. Due to the installation of a new scanner, study recruitment was temporarily suspended; therefore, we have completed fewer acquisitions than projected. We will continue to recruit at an accelerated pace to meet our recruitment goals.

▪ **What opportunities for training and professional development has the project provided?**

Nothing to report.

▪ **How were the results disseminated to communities of interest?**

Nothing to report

▪ **What do you plan to do during the next reporting period to accomplish the goals?**

We plan to continue recruitment at an accelerated rate to meet the study goals.

4. **IMPACT:**

- **What was the impact on the development of the principal discipline(s) of the project?**

Nothing to report.

- **What was the impact on other disciplines?**

Nothing to report.

- **What was the impact on technology transfer?**

Nothing to report.

- **What was the impact on society beyond science and technology?**

Nothing to report.

5. **CHANGES/PROBLEMS:**

- **Changes in approach and reasons for change**

Nothing to report.

- **Actual or anticipated problems or delays and actions or plans to resolve them**

The project start was delayed due to installation of a new magnetic resonance imaging scanner in the Minneapolis VA's Radiology service. The installation period resulted in a backlog for clinical scans, minimizing the number of acquisitions allotted for research. The scanner is now fully functional, the backlog is resolved, and our research team has been guaranteed slots in order to fulfill the study goals.

- **Changes that had a significant impact on expenditures**

Nothing to report.

- **Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents**

Nothing to report.

- **Significant changes in use or care of human subjects.**

Nothing to report.

- **Significant changes in use or care of vertebrate animals.**

Not applicable.

- **Significant changes in use of biohazards and/or select agents**

Not applicable.

6. **PRODUCTS:**

- **Publications, conference papers, and presentations**

Journal publications.

Nothing to report.

- **Books or other non-periodical, one-time publications.**

Nothing to report.

- **Other publications, conference papers, and presentations.**

Nothing to report.

- **Website(s) or other Internet site(s)**

http://brain.umn.edu/GWI_autoimmune.shtml

- **Technologies or techniques**

Nothing to report.

- **Inventions, patent applications, and/or licenses**

Nothing to report.

- **Other Products**

We have developed a database in order to facilitate data analysis and dissemination of research findings.

7. **PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS**

- **What individuals have worked on the project?**

Name:	<i>Apostolos Georgopoulos</i>
Project Role:	<i>PI</i>
Researcher Identifier (e.g. ORCID ID):	
Nearest person month worked:	<i>2</i>
Contribution to Project:	<i>Study design and oversight.</i>
Funding Support:	<i>VA CSR&D</i>

Name:	<i>Brian Engdahl</i>
Project Role:	<i>Co-Investigator</i>
Researcher Identifier (e.g. ORCID ID):	
Nearest person month worked:	2
Contribution to Project:	<i>Identification of potential participants.</i>
Funding Support:	VA CSR&D

Name:	<i>Lisa James</i>
Project Role:	<i>Co-Investigator</i>
Researcher Identifier (e.g. ORCID ID):	
Nearest person month worked:	3
Contribution to Project:	<i>Completion of regulatory documents, participant recruitment, and data acquisition.</i>
Funding Support:	VA CSR&D

Name:	<i>Arthur Leuthold</i>
Project Role:	
Researcher Identifier (e.g. ORCID ID):	1234567
Nearest person month worked:	2
Contribution to Project:	<i>MEG data acquisition, quality control, and pre-processing.</i>
Funding Support:	VA CSR&D

Name:	<i>Adam Carpenter</i>
Project Role:	Other significant contributor
Researcher Identifier (e.g. ORCID ID):	
Nearest person month worked:	2
Contribution to Project:	<i>Oversight of neurological exams and MRI acquisition.</i>
Funding Support:	

- **Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?**

A pending grant involving Drs. Georgopoulos, James, Engdahl, and Carpenter has been awarded in this reporting period.

- **What other organizations were involved as partners?**

Nothing to report.

8. SPECIAL REPORTING REQUIREMENTS

Nothing to report.

9. APPENDICES

Nothing to report.